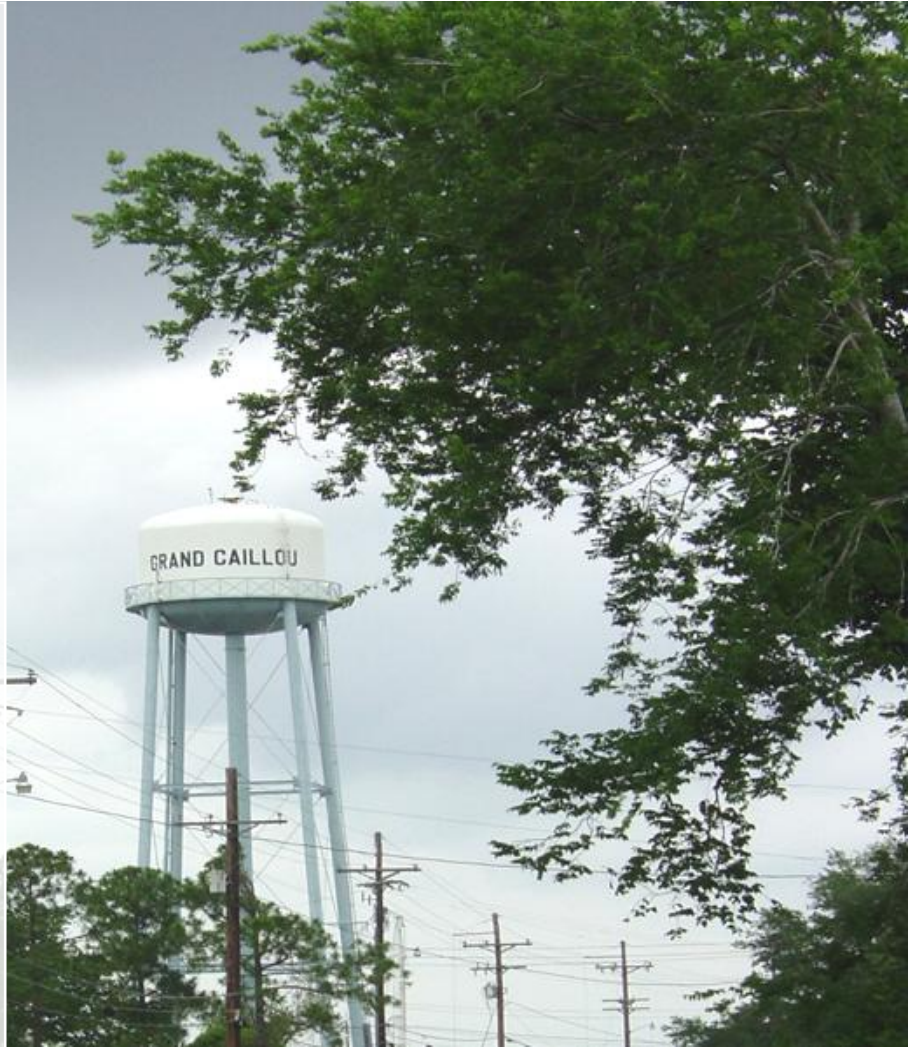


Implementation Plan 120501

Bayou Grand Caillou

2008



Subsegment 120501, Bayou Grand Caillou – From Houma to Bayou Pelton, was listed on the 2006 303(d) list as not supporting the Fish and Wildlife Propagation designated use. It was subsequently scheduled for TMDL development with other listed waters in the Terrebonne Basin. The waterbody was considered impaired for low dissolved oxygen and nutrients. Suspected sources were forced drainage pumping, municipal point source discharges, and natural conditions.

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Implementation Plan 120501

1.0 Introduction

Water quality has been one of the major environmental issues across the country for over 30 years (Adams et al. 2000). Negative impacts from man-made activities have resulted in many of Louisiana's water bodies not meeting the State water quality standards causing them to be classified as impaired. The Clean Water Act (CWA) of 1972 requires that water bodies in all states meet minimum surface water quality standards. Pollutants from both point sources (ex. factories, sewage facilities) and nonpoint sources (ex. yards, pastures, field runoff) play a role in poor water quality. Louisiana has over 285 stream segments listed on the EPA 303(d) list as impaired for one or more pollutants.

Major efforts are now underway in Louisiana to improve the quality of surface waters. State and federal agencies, universities, industry, and business/citizen groups have formed a wide variety of partnerships to move forward in solving water quality problems in the state. Water quality solutions are often complicated and require the cooperation of many different groups.

Surface water quality management is approached by state and federal agencies on a watershed basis. A watershed is simply an area of land drained by a particular set of streams and rivers. Louisiana has 12 major watersheds composed of smaller sub-watersheds. These watersheds often cross political boundaries. For example, several watersheds in Louisiana are shared with the neighboring states of Arkansas, Mississippi and Texas.

The Louisiana Department of Environmental Quality (LDEQ) is responsible for identifying water quality problems (impairments) in each watershed. Once a problem is identified, Total Maximum Daily Loads (TMDLs) are developed to address the impairments. In January 2005, LDEQ established the Bayou Grand Caillou Watershed TMDL For Biochemical Oxygen-Demanding Substances and Nutrients to address dissolved oxygen and nutrient impairments in the Grand Caillou watershed.

TMDLs address both point sources and nonpoint sources. This means that municipalities, homeowners, farmers, businesses and industries will all be expected



Figure 1: Bayou Grand Caillou

to address pollution in watersheds that contain impaired water bodies. Point sources are addressed under the LPDES permit program, while nonpoint sources can be addressed by Best Management Practices (BMPs).

This document describes the best management practices (BMPs) that are recommended to address the nonpoint source (NPS) pollution in the Bayou Grand Caillou watershed. A consolidated list of recommended BMPs can be found in the State of Louisiana Water Quality Management Plan, Volume 7, Louisiana's Nonpoint Source Management, 2000.

Additionally, helpful programs designed to promote good surface water quality in agricultural areas are managed by the Natural Resource Conservation Service (NRCS) in Louisiana. Many farmers and landowners participate in the Environment Quality Incentive Program (EQIP), Wetlands Reserve Program (WRP) and Conservation Reserve Program (CRP). These and other USDA conservation programs provide cost-share and technical assistance to help improve environmental quality.

1.1 Ecoregion and Terrebonne River Basin Description

The Terrebonne Basin covers an area extending approximately 120 miles from the Mississippi River on the north to the Gulf of Mexico on the south. It varies in width from 18 miles to 70 miles. This basin is bounded by the Atchafalaya River Basin on the west and by the Mississippi River and Bayou Lafourche on the east.

The topography of the entire basin is lowland, and all the land is subject to flooding except the natural and manmade levees along major waterways. The coastal portion of the basin is susceptible to tidal flooding and consists of marshes ranging from fresh to saline.” (LA DEQ, 1996).

Land-use within the northern parts of the Basin consists primarily of urban

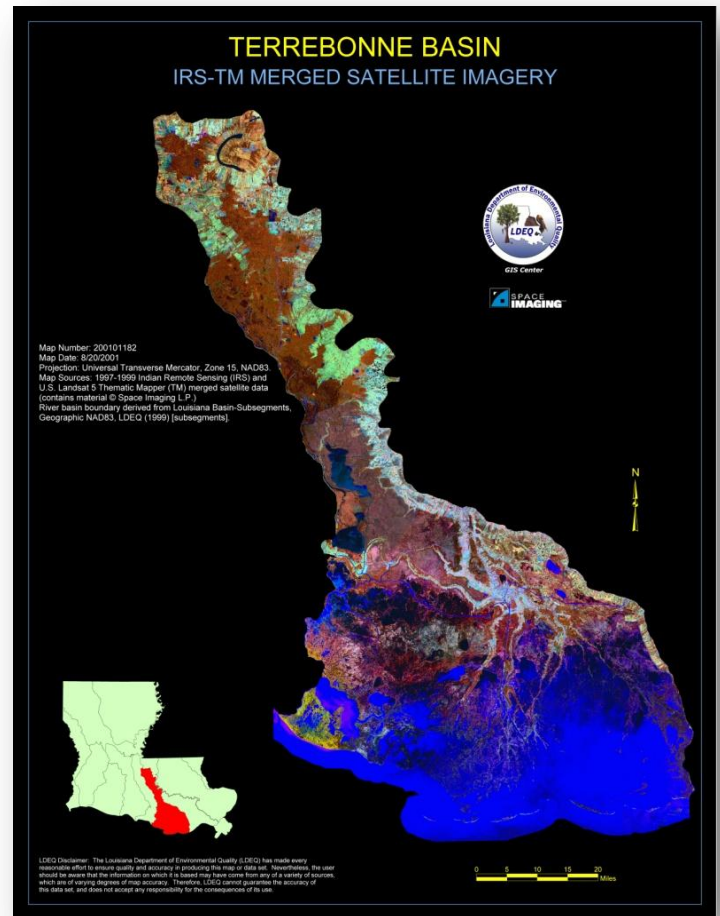


Figure 2: Terrebonne Basin

development and agriculture. Wetland forests and marshes dominate the southern parts of the Basin.

2.0 Watershed Land Use

2.1 Bayou Grand Caillou Watershed Description

A watershed is defined as the area of land that drains into a specific river, lake or bayou. Watersheds provide a structured framework for the evaluation and mitigation of water quality impairments. Using a watershed approach allows stakeholders to target solutions to areas that are most likely to contribute to local water quality problems. This increases the likelihood of water quality improvements and results in a higher return investment from water quality funding.

Bayou Grand Caillou, subsegment 120501, is located in the Terrebonne Basin and is approximately 12 miles long. The subsegment includes Bayou Grand Caillou from the Intracoastal Waterway to Bayou Pelton and includes the St. Louis Canal as a tributary. Almost six miles from the headwaters of Bayou Grand Caillou with the ICWW, there is a dam with a pumping plant that operates when the level north of the dam has to be reduced. The flow from the headwaters to the dam is entirely controlled by this pumping station. The water levels on Bayou Grand Caillou are controlled by flow from the pumping station to Bayou Pelton. This subsegment is also tidally influenced, which can lead to reduced flushing and longer retention time for pollutants in the waterway.

Soils in this watershed are similar to those throughout the Terrebonne Basin. They are characterized by a predominance of wet, poorly drained soils (silt loam, clay, muck, mucky clay, silty clay loam). Average annual precipitation in the segment, based on the nearest Louisiana Climatic Station, is 64 inches based on a 30-year period of record (LSU, 1999).

The area is sparsely populated and land use is dominated by urban development, agriculture, and forested wetlands.

Land Use	Acres	Percentage
Bare	218	4.0
Deciduous Forest Land	171	3.1
Forested Wetland	1,882	34.4
Pasture/Hay	560	10.2
Sugarcane	619	11.3
Urban	1,991	36.4
Water	32	0.6

As shown in Table 2, agricultural uses are predominately sugarcane fields and pasture

land. The TMDL report found only four permitted point source discharges located in this subsegment at the time of development.

Urban and residential developments followed by sugarcane fields are the most likely contributors of nonpoint source pollutant loading in Subsegment 120501.

2.2 Designated Uses of Subsegment 120501

In addition to existing day-to-day uses, waterbodies in the state of Louisiana have designated uses. A designated use is defined as a use of these waters as established by the water quality standards provided in the Louisiana Administrative Code, LAC 33:IX.111. LAC 33:IX.1123. Table 3 defines the designated uses for Subsegment 120501, Bayou Grand Caillou – from the Headwaters to Bayou Pelton, as Primary Contact Recreation, Secondary Contact Recreation, and Fish and Wildlife Propagation. This means that Bayou Grand Caillou should support uses such as swimming and skiing (primary contact), fishing and boating (secondary contact), and aquatic habitat (fish and wildlife propagation).

2.3 Field Survey of the Bayou Grand Caillou Watershed

In August of 2003, the LDEQ Watershed Survey Group conducted an intensive survey of Bayou Grand Caillou. Water samples were taken throughout the length of the bayou along with in-situ readings and flow measurements. Samples were taken during the summer critical conditions. Four small discharges were noted during the survey along this subsegment. All four dischargers had a flow of less than 5000 gallons per day. The Watershed Survey crew encountered some problems while conducting the survey due to the amount of vegetation in the bayou, making it difficult to get accurate flow

measurements using the flow meters. The survey crew took the best possible flow and cross-sectional measurements. All of the data collected were utilized to develop the TMDL model of the bayou.



Figure 3: Grand Caillou pumping station (right) and station intake structure (left).

In December 2008, LDEQ Nonpoint staff along with a Barataria-Terrebonne National Estuary Program (BTNEP) representative toured the watershed along Hwy 57 from Houma to Dulac. The upper parts of the watershed in and around Houma were populated with subdivisions, retail centers, and industrial users (primarily oilfield service) mixed with some sugarcane production. The lower parts of the watershed were composed primarily of residential dwellings and industrial users. Seafood processing facilities, oilfield service companies, and drydocks all operate directly on the banks of the bayou. Pumping stations for flood control and agricultural use were found in both the upper and lower watershed. The upper watershed pumping station, used to control stormwater surges, isolates the headwaters from the lower bayou. This station is about 6 miles from the headwaters.

3.0 Water Quality Analysis

Bayou Grand Caillou, Subsegment 120501, was listed on the 2006 303(d) list as impaired for nutrients (nitrate + nitrite as N), organic enrichment/low dissolved oxygen, phosphorus, and non-native aquatic plants. This subsegment was originally listed on the

1999 Court Ordered 303(d) list as impaired with pesticides, nutrients, oil & grease, organic enrichment/low dissolved oxygen (DO), pathogen indicators, and noxious aquatic plants. It was subsequently listed on the 2002 and 2004 303(d) lists as well (with the addition of total phosphorus). In 2003, the subsegment was slated for TMDL development to address the dissolved oxygen and nutrient impairments. Table 2 shows the use impairments and the suspected causes.

Subsegment Number	Impaired Use for Suspected Cause	Suspected Causes of Impairment	Suspected Sources of Impairment
LA 120501	FWP	Nitrate/Nitrite (Nitrite + Nitrite as N)	Forced Drainage Pumping
LA 120501	FWP	Nitrate/Nitrite (Nitrite + Nitrite as N)	Municipal Point Source Discharges
LA 120501	FWP	Nitrate/Nitrite (Nitrite + Nitrite as N)	Natural Sources
LA 120501	FWP	Non-Native Aquatic Plants	Introduction of Non-native Organisms (Accidental or Intentional)
LA 120501	FWP	Oxygen, Dissolved	Forced Drainage Pumping
LA 120501	FWP	Oxygen, Dissolved	Municipal Point Source Discharges
LA 120501	FWP	Oxygen, Dissolved	Natural Sources
LA 120501	FWP	Phosphorus (Total)	Forced Drainage Pumping
LA 120501	FWP	Phosphorus (Total)	Municipal Point Source Discharges
LA 120501	FWP	Phosphorus (Total)	Natural Sources

Table 2: 2006 303(d) listed impairments

3.1 Existing Water Quality in Bayou Grand Caillou

In accordance with Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a comprehensive program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section routinely collects surface water samples throughout the state as part of the ambient surface water monitoring program. The objectives of the program are to determine the quality of the state's surface waters, to develop a long term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303 (d) list of impaired waters. Waterbodies are considered to be impaired when they are not meeting the established water quality criteria.

Currently, the water quality criterion for dissolved oxygen in Louisiana waterbodies is 5.0 mg/l. Figure 3 shows recent dissolved oxygen measurements from Bayou Grand Caillou (2005 and 2007 samplings were interrupted by hurricane activities). Note that dissolved oxygen in the bayou is consistently less than 5.0 mg/l during the summer months.

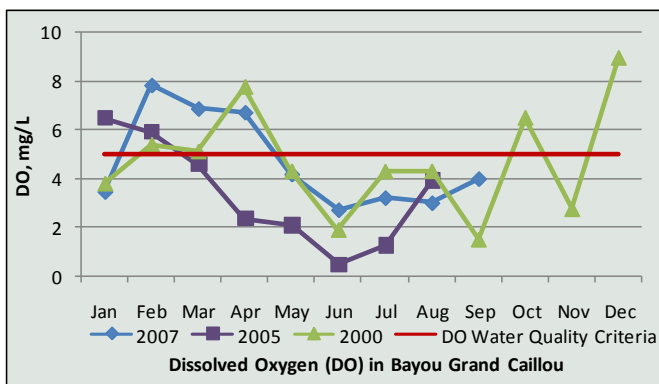


Figure 4: Bayou Grand Caillou DO data 2000, 2005, 2007

LDEQ currently addresses nutrient loading through a narrative criteria. LAC 33:IX.1113.B.8

states, "The naturally occurring range of nitrogen-phosphorus ratios shall be maintained...Nutrient concentrations that produce aquatic growth to the extent that it creates a public nuisance or interferes with designated water uses shall not be added to any surface water." Until numeric nutrient criteria are developed, the narrative criteria are evaluated based on levels of vegetation in the waterway, eutrophication problems, and the DO levels. Figure 4 gives an idea of nutrient levels (Nitrate-Nitrite as N, Total Kjeldahl Nitrogen, Total Phosphorus) in Bayou Grand Caillou in 2007. Section 2.3 mentioned that the survey crew did encounter excessive vegetation in the bayou and the monitoring data show the bayou is not meeting the DO criteria.

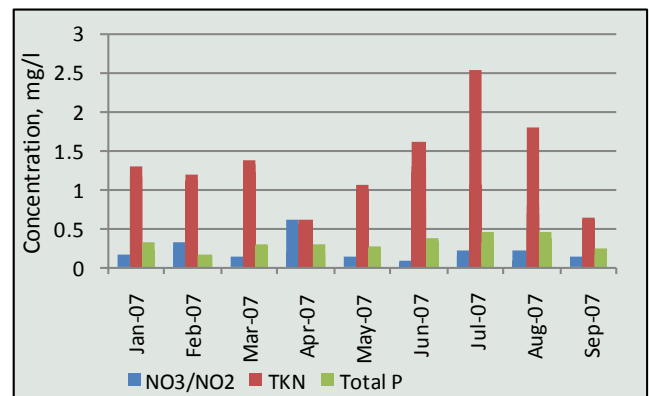


Figure 5: Bayou Grand Caillou 2007 nutrient data

In January 2005, LDEQ established the Bayou Grand Caillou Watershed TMDL for Biochemical Oxygen-Demanding Substances and Nutrients to address dissolved oxygen and nutrient impairments in the Grand Caillou watershed. The results of the TMDL projection modeling for subsegment 120501 show that the water quality standard of 5.0 mg/l for dissolved oxygen could be maintained during the winter critical season if there was an 80% reduction of total nonpoint pollution load. Achieving this reduction could result in a minimum DO of

5.36 mg/l in subsegment 120501. However 5.0 mg/l is a national dissolved oxygen criterion. There are many water bodies in Louisiana that fully support wildlife habitat and growth with much lower dissolved oxygen levels. LDEQ is currently assessing data to establish state-specific DO criteria. A Use Attainability Analysis (UAA) was recently completed for the Barataria and Terrebonne Basins. Information on the UAA can be found at <http://www.deq.louisiana.gov/portal/tabid/2888/Default.aspx>. LDEQ will use the data from the UAA to promulgate new, ecoregion-specific criteria for some subsegments of the Barataria and Terrebonne basins. Should the criteria for Subsegment 120501 be revised, it may lower the nonpoint source reductions required by the TMDL. However, until the criteria and/or TMDL is revised, the goal will remain at 80% reduction of nonpoint source DO and nutrient loading.

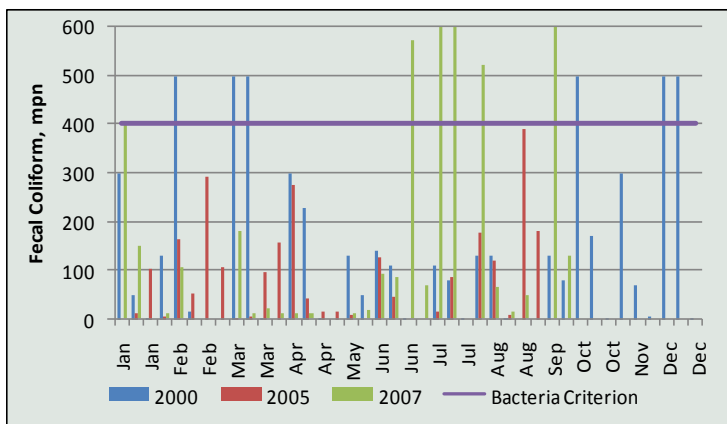


Figure 6: Bayou Grand Caillou Fecal Coliform Data

The draft 2008 303(d) list indicates that Bayou Grand Caillou (subsegment 120501) is no longer meeting the primary contact recreation designated use (<http://www.deq.louisiana.gov/portal/Portals/o/planning/o8%20IR1-DRAFT%20Assessments%20Public%20Notice%20REV%201.xlsx>). Primary contact recreation is defined as any water contact use involving prolonged or regular full body

contact with water and in which the probability of ingesting appreciable amounts of water is considerable (ie. swimming, skiing, diving). This use requires fecal coliform density in the waterway to be below 400 colonies/100 ml (mpn) 75% of the time during the recreational period of May 1–Oct 31. Figure 5 shows elevated levels of fecal coliform bacteria in Bayou Grand Caillou in 2007. Suspected sources of fecal coliform bacteria include unpermitted discharges of domestic waste, improperly maintained septic systems, and urban stormwater runoff. To date, a Fecal Coliform TMDL has not been established for this subsegment.

LDEQ is continuing to implement a watershed approach to the surface water quality monitoring program. In 2004 a four year sampling cycle replaced the previous five year cycle. Approximately one quarter of the states watersheds will be sampled in each year so that all of the states watersheds will be sampled within the four year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added or removed from the 303(d) list.

4.0 TMDL Findings and Recommendations



WLA= Waste Load Allocation (point sources)
LA= Load Allocation (non-point sources)
MOS= Margin of Safety
SV= Seasonal Variation

Figure 7: TMDL Basic Equation

4.1 Bayou Grand Caillou Watershed TMDL for Biochemical Oxygen-Demanding Substances and Nutrients

As stated above, a TMDL for biological oxygen-demanding substances and nutrients was developed for subsegment 120501 based on hydrologic and water quality data available as of February 2000. TMDL development was driven by the 1999 303(d) and 2000 303(d) lists which both indicated that Bayou Grand Caillou was not meeting the fish and wildlife propagation designated use.

The suspected causes of impairment of the designated use included organic enrichment/low DO, nitrogen, phosphorus, pesticides, suspended solids, turbidity, salinity/TDS/chlorides/sulfates and pathogens. Suspected sources of impairment included agriculture, non-irrigated crop production, pastureland, land disposal and onsite wastewater (septic tanks).

The TMDL established load limitations for oxygen-demanding substances and called for an 80% reduction in nonpoint source loading. LDEQ's position on nutrients, as supported by the ruling in *Sierra Club v. Givens*, 710 So.2d 249 (La. App. 1st Cir. 1997), writ denied, 705 So.2d 1106 (La. 1998), is that when oxygen-demanding substances are controlled and limited in order to ensure that the dissolved oxygen criterion is supported, nutrients are also controlled and limited. Therefore, the implementation of this TMDL through wastewater discharge permits and best management practices to reduce inputs of oxygen-demanding pollutants from nonpoint sources should also reduce nutrient loading.

5.0 Identification of Nonpoint Sources and High Priority Areas

Based on the water quality data and TMDL findings, nonpoint pollutants of concern for this watershed include sedimentation, nutrient runoff, and fecal coliform bacteria. Based on land use, suspected sources of these pollutants in Subsegment 120501 are urban stormwater, failing home septic systems, and agricultural runoff from sugarcane fields. Note that forested wetlands and marsh compose a significant percentage of land use in the watershed, but are not nonpoint source pollution contributors.

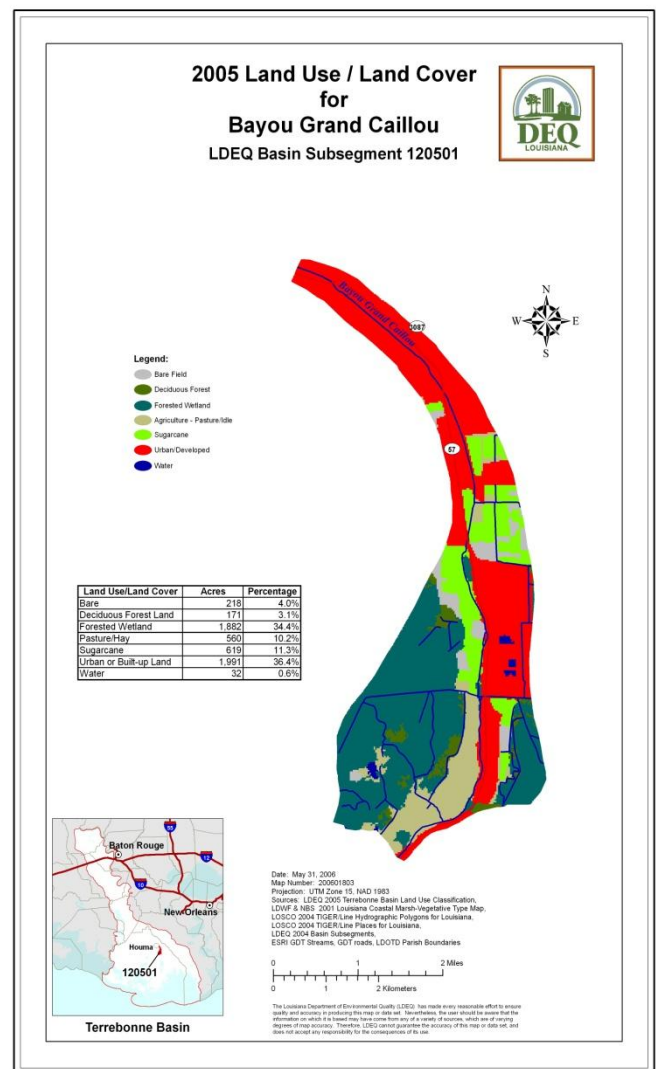


Figure 8: Terrebonne Basin Land Use Map

The following high priority areas have been selected based on the land use type, protection of the population, and restoration within the watershed.

5.1 Urban Impact

The most significant NPS effects on the Grand Caillou watershed appear to be from existing urban development and from the ongoing conversion of other land uses to urban uses. Urban nonpoint source pollution is not limited to large communities. Rural areas, such as those in the Bayou Grand Caillou watershed, can also have significant impacts.



Figure 9: Industrial facility in the upper watershed

For example, roads near the bayou are used for commercial transport, agricultural activities and residential travel. Petroleum products and particulates from exhaust become concentrated on these roadways and are easily washed into Bayou Grand Caillou during rain events. Urban development often leads to the elimination of natural channels, including the loss of wetlands, wildlife, fisheries and riparian habitat. This is evident in the upper watershed where concrete coulees replaced the original stream channel.



Figure 10: Homes along Bayou Grand Caillou

Hydrologic changes, such as routing water to ditches and coulees, causes equilibrium upsets that result in destabilization and erosion of the remaining channels and more frequent flooding. Waterways also experience increased sedimentation from construction site runoff and increased pollutant loads associated with urban human activity such as nutrients, pathogens, pesticides, PAHs (polycyclic aromatic hydrocarbon [carcinogens]), petroleum, salts, nitrates, metals, and trash.

The lower reaches of Bayou Grand Caillou experiences a large volume of boat traffic, both recreational and commercial. Bilge discharges add oil & grease to the waterway. Sandblasting and refinishing operations add particulates, metals, and chemicals.

5.2 On-Site Disposal (Septic Tank/Package Treatment) Impact

Sewage discharges from homes, camps, and businesses that are not connected to a municipal sewerage treatment facility or from vessels (recreational and commercial) and faulty pump out facilities are significant contributors of nonpoint source pollution. It is estimated that over 50% of individual waste disposal systems in the state are malfunctioning due to incompatible soil types or lack of maintenance. These failing systems are a major cause of water quality degradation in Louisiana's bayous and fresh water aquifers. Improperly maintained or poorly designed treatment systems discharge untreated wastewater (sewage) into local surface and groundwater. These discharges contribute to elevated fecal

coliform colonies and nutrients in local waterways. LDHH estimates that there are 210 small residential sewage treatment plants and 10 larger extended aeration plants that discharge either directly to Bayou Grand Caillou or into road-side ditches that ultimately drain to Bayou Grand Caillou.

5.3 Agricultural Impact - Sugarcane

Sugarcane is the primary row crop found within the Bayou Grand Caillou watershed. According to the LSU Ag Center's 2007 Louisiana Agricultural Summary, there were 14 producers of sugarcane in Terrebonne Parish, farming on a total of 10,405.5 acres and yielding 71,777,139 lbs of sugarcane. The land use data (Table 1 and Figure 8) indicate approximately 619 acres of sugarcane production in Bayou Grand Caillou's watershed.

Soil tillage is the common practice for preparing these types of row crops. During a rainfall event, loose soil from tilled areas can be easily washed into the receiving stream resulting in siltation and increased oxygen demand.

Sediment increases the turbidity, thereby reducing light penetration, impairing photosynthesis and altering oxygen relationships. This may reduce the food supply for certain aquatic organisms. Fish populations can be adversely affected in areas where deposits cover spawning beds. (LSU AgCenter, 2002). Siltation causes a decrease in-stream depth which can result in higher in-stream temperatures. Warmer water holds less dissolved oxygen and often leads to increased microbial and algal activity.



Figure 11: Sugarcane production along headwaters of Bayou Grand Caillou

Microbe and algal life cycles consume oxygen in the stream resulting in lower DO values.

Additionally, this sediment runoff often has fertilizers, pesticides, and herbicides adsorbed to the soil particles. If the flow rate within the bayou is low, these sediments can deposit and accumulate on the stream bottom. Nutrients feed microbial, algal, and macrophyte populations, while pesticides and herbicides consume oxygen as they are degraded and can cause localized toxicity to aquatic populations.

5.4 Agricultural Impact – Grazing/Pasture

There are 560 of acres in pasture/hay production in the Bayou Grand Caillou watershed. Properly managed pastures require applications of fertilizer and herbicides to create high quality forage for grazing and hay production. Over application of fertilizers and herbicides, application at improper times (such as directly preceding rainfall events), and application in or near creeks and ditches can result in these chemicals being washed into near by creeks and feeder streams during rain events.

Livestock also can have a significant impact on nonpoint source pollution loading in a watershed. Livestock produce large quantities of manure. Rainfall carries nutrients and fecal coliform bacteria from manure to area streams. As mentioned above, excessive nutrient levels promote algal growth and can lead to eutrophic conditions (low DO). Additionally, livestock operations can contribute to increased sedimentation in local streams. Feeding and watering areas, where animals congregate, are often bare of vegetation. Exposed soils in these areas can be dislodged by rainfall and then carried to

local bayous by runoff. In areas where animals are allowed access to creeks and waterways, stream beds can be severely eroded. As mentioned before, excess sediment in stormwater runoff impacts flora and fauna and adversely affects DO levels.

However, as shown in Figure 8, the bulk of this land use is located in the lower watershed, Subsegment 120502. Subsegment 120502 is not currently addressed by this implementation plan.

5.5 Summary of High Priority Areas in Subsegment 120501

High priority areas in this watershed include stormwater from residential and commercial areas, improperly maintained individual package treatment plants and septic tank systems, and agricultural runoff from sugarcane fields.

These areas should be targeted for a broad array of conservation activities including watershed-level protection efforts, restoration activities, reforestation of banks and riparian areas with native vegetation, maintenance or restoration of natural flow and temperature regimes, protection of surrounding lands through conservation easements or land acquisition, and development of physical and biological monitoring programs.



Figure 12: Work-site on the bank of Bayou Grand Caillou. Notice the riparian zone completely devoid of vegetation.

It is important to note that high priority areas are only a starting point to guide conservation efforts. Additional information on land cover, land use change, proximity to existing protected areas, water quality, location of impoundments and other factors should also be considered when defining conservation priorities. Foremost, many of these "non high-priority" waters may be added to the list in the future as new information becomes available. Similarly, because of the inherent connectivity in aquatic and coastal ecosystems, degradation of one system may impact another.



Figure 13: Sugarcane harvesting (photo by Jonny Morgan, LSU Agcenter)

Finally, 80% nonpoint load reductions required by the TMDL are based on modeling that included only 4 point source discharges. More recent data indicates that over 40 point sources are now covered under LPDES permits. Based on LDEQ observations in the watershed and surveillance records, there are many more facilities that will eventually be regulated by permits. This data has the potential to change the reductions required for nonpoint sources.

6.0 Nonpoint Source Pollution Solutions

Bayou Grand Caillou headwaters are primarily stormwater runoff from suburban areas of southern Houma. Flood control and agricultural pumping activities have resulted in a bayou dominated by stormwater inputs

and tidal fluxes. This makes BMP implementation and nonpoint pollution control essential to protect water quality in the bayou. In general, more riparian buffers, treatment of runoff, and agricultural BMPs are necessary throughout the upper and middle parts of the watershed. By using some of the state and federal incentive programs, stake holders may be able to obtain funding for implementing and installing best management practices (BMPs) in the watershed.

BMPs are effective practices that act to reduce the nonpoint pollution load in water systems and decrease the velocity of runoff after storm events. These practices are usually created and maintained for long-term use and coincide with the local water quality standards for a particular area. Selection and suitability of a BMP should be based on: site specific conditions, type of land use activity, the physical makeup of the watershed, and consideration of the pollutant(s) involved. Implicit within the BMP concept is a voluntary, site-specific approach to water quality problems. Many of these methods are already standard practices, known to be both environmentally and economically sustainable.

Although a wide variety of BMPs are available, specific BMPs designed to address the problems in Bayou Grand Caillou are recommended in this document.

This plan is a package of techniques: some designed to address existing problems, others to address new, future problems. Some techniques address both. Five general watershed management techniques are recommended for the Bayou Grand Caillou Watershed:

1. **New Development Site Management:** controlling the quality and quantity of water running off future development sites through density and impervious area limits and enhanced peak flow requirements or through on-site performance standards.
2. **Monitoring and Enforcement:** enhanced monitoring and enforcement programs to ensure the proper performance and maintenance of wastewater/stormwater/septic systems as well as compliance with local laws, and to measure the effectiveness of actions in protecting and restoring Louisiana streams and lakes.
3. **Education/Citizen Stewardship:** programs to increase citizens' and developers' awareness of and participation in watershed management efforts.
4. **Point Source Controls:** efforts to upgrade existing wastewater treatment facilities and to phase out older facilities.
5. **Stream and Wetland Restoration Projects:** efforts to restore some of the natural functions and characteristics of impaired water bodies.

Each of these techniques helps mitigate or prevent pollution. To be most effective, all five must be employed together.



6.1 Urban and Suburban BMPs

Reducing NPS pollutant loading in urban and suburban areas of a watershed involves managing the existing sources of pollution and preventing the development of new sources. NPS pollution is driven by stormwater runoff, therefore BMPs should be focused on strategies that prevent or reduce exposure of NPS pollution sources to stormwater. BMPs are best implemented through site plan controls, stormwater management plans, subdivision agreements, local ordinances, and erosion and control guidelines and standards. For example, decisions regarding land-use planning and protection of urban water resources are usually governed at the municipal level.

Increasing the public's level of environmental awareness is the first step for solving NPS problems in urban areas of a watershed. When attempting to implement local BMP programs, success will depend upon residents having a clear understanding of the nonpoint pollution problem, potential sources of concern, and the overall program goals.

Public Awareness

A powerful defense against nonpoint pollution involves public education, awareness, and participation. The following are simple tasks which everyone can use to reduce nonpoint source pollution:

1. *Keep litter, pet wastes, leaves and debris out of street gutters and storm drains.*
2. *Mark storm drains with messages to warn citizens of environmental hazards of dumping materials into them.*
3. *Apply lawn and garden chemicals sparingly and according to directions.*

4. *Dispose of used oil, antifreeze, paints and other household chemicals properly, not in sewer or drains.*
5. *Clean up spilled brake fluid, oil, grease and antifreeze. Do not hose them into the street where they will eventually reach local streams, lakes and bayous.*
6. *Control soil erosion on your property by planting ground cover and stabilizing erosion prone areas.*
7. *Encourage local government officials to develop construction erosion/sediment control ordinances in the community.*
8. *Purchase household detergents and cleaners that are low in phosphorous to reduce the amount of nutrients discharged in our water bodies.*
9. *Wash your car on the grass so soapy water soaks into the ground. Use a hose nozzle to prevent water from running when not in use.*

BMP	Total Suspended Solids	Total Phosphorus	Nitrate and Nitrite
Dry Ponds	47%	19%	4%
Wet Ponds	80%	51%	43%
Infiltration Systems	95%	70%	82%
Filtration Systems	86%	59%	-14%
Bioswales	81%	34%	31%
Wetlands	76%	49%	67%

Table 3: Urban Stormwater BMPs and percent pollution reduction

Detention Ponds

Detention ponds (dry ponds) are structures which are often built in residential areas to alleviate stormwater runoff and retain precipitation from storm events. Detention ponds are basins that temporarily store stormwater runoff from a site and release it at

a controlled rate to minimize downstream flooding. Holding water for a minimum time and then completely draining the system allows pollutants to be filtered by the vegetation along the edges and bottom of the pond. Stormwater can then infiltrate into the soil or flow out the basin slowly into a surface water body. Design is the key in detention ponds. Properly designed detention ponds are capable of removing 47% of total suspended solids (Table 3). As mentioned above, a detention pond *temporarily* stores runoff. Some may have concerns about detention ponds becoming breeding grounds for mosquitoes. A properly designed, operated, and maintained pond should drain within 72 hours. Therefore it should not be a fertile breeding ground for mosquitoes.

Filter Strips

Filter strips are wide areas of vegetation that act to intercept runoff into lakes, rivers, or bayous. They can consist of any type of rock and dense vegetation from woodlands to grass and can remove various pollutants, such as heavy metals, sediment loads, and excess organic materials. Filter strips perform well for small light-intensity rainfalls, and should be shaped uniformly so that water moves into the vegetative strip without being concentrated. The cost of constructing a filter strip is very low, especially reduced if constructed before development of the surrounding area. According to an NRCS Field Guide, the state average cost of a filter strip in 2008 ranges from \$50 to \$150 per acre.

Swales

Vegetated Swales are broad, shallow channel depressions with a dense stand of vegetation

covering side slopes and bottom. Swales can be natural or manmade, and are designed to trap particulate pollutants such as suspended solids (81% removal) and trace metals (about a 51% removal rate for copper and 71% removal rate for zinc), promote infiltration, and reduce the flow velocity of storm water runoff. Swales slow the flow of the runoff allowing particulates to settle out and water to infiltrate into the soil. Swales can effectively remove small amounts of excess nutrients and some heavy metals.

Rain Gardens

A rain garden is a man-made depression in the ground that is used as a landscape tool to improve water quality. The rain garden forms a bio-retention area by collecting runoff and storing it, allowing it to be slowly absorbed and filtered by the soil. The site for the rain garden should be placed strategically to intercept water runoff. It is also necessary to use Louisiana native wetland plants (e.g., Copper Iris and Arrowhead) when constructing a rain garden. Using indigenous species will ensure a stable ecological environment.



Figure 14: Vegetated Swale

Constructed Wetlands

Constructed wetlands are an alternative wastewater treatment method that mimics natural processes to treat wastewater. They are often used in mitigation of other areas that have lost wetlands due to development (e.g., schools or businesses). Natural and constructed wetland areas are saturated for extended time periods and are able to support unique vegetation adapted for life in submerged conditions. Wetlands are extremely efficient in filtering sediment, nutrients, and some heavy metals from storm

water runoff and overflow of nearby water systems. A properly constructed wetland should produce an effluent with less than 30 mg/L biochemical oxygen demand (BOD), less than 25 mg/L total suspended solids (TSS) and less than 10,000 cfu/100mL fecal coliform bacteria. Costs to build a constructed wetland vary with site conditions, the design and local requirements.



Figure 15: Permeable pavement (left) and curb cuts (right)

Pervious or Porous Pavement

Pervious or porous materials allow water to enter the ground cover through spaces in the material. Parking lots, in particular, hold a tremendous potential for this material because of the amount of oil and other hydrocarbon liquids that seep from parked cars. Homeowners can use pervious concrete as well, to eliminate pooling, prevent erosion, and save the expense of tying into storm sewer systems. A normal concrete parking lot allows more than 98% of water runoff to leave the area, carrying pollutants and chemicals into waterways. Pervious pavements can be made of concrete, asphalt, open-celled stones, and gravel that are mixed in a manner that creates an open cell structure allowing water and air to pass through. When pervious concrete is used for paving, it can take in stormwater at a rapid rate of 3 to 5 gallons per minute per square foot of surface area, which exceeds the flow rate needed to prevent runoff in most rain events. The cost of a

pervious parking lot will vary depending on the materials used and the size. Pervious parking lots are more expensive than traditional concrete parking lots, however a pervious lot can reduce the need for installing expensive drainage systems to handle stormwater runoff.

A retro-fit BMP to filtering parking lot pollutants are breaks in the concrete curb called **Curb Cuts**. Gaps in the curbs of the vegetative areas in the lot can be cut to capture and filter runoff. This is essential in new parking lot design, but can also be used in older lots.

6.2 On-Site Disposal (Septic Tank/Package Treatment) BMPs

Failing home septic systems have the potential to cause significant problems in the watershed by contributing nutrients, organic matter, and fecal coliform bacteria. Prevention practices such as proper installation, location, size, and maintenance are the best way to eliminate NPS loads from home systems. . Many of the problems that result from home septic systems occur because of lack of knowledge about the system. Septic systems should not be installed without obtaining the proper permits from the State Health Officer. In addition, sewer systems should be inspected and pumped out every 3-5 years by a licensed professional.

6.3 Agricultural BMPs - Sugarcane

Sugarcane is the predominant crop grown in subsegment 120501. According to land use data, there are approximately 619 acres of land in this watershed in sugarcane production. The most cost effective reduction of nonpoint source pollution loads in agricultural settings is dependent on the implementation of effective best management

practices (BMPs) in critical source areas. (Maas et al., 1985; Ice, 2004). Louisiana currently has a BMP manual specifically for sugarcane production that can be viewed at <http://www.lsuagcenter.com/NR/rdonlyres/83ABA47A-8DBB-47A3-B3AB-85C85B1B930D/3155/pub2833Sugarcane4.pdf>. Highlight from this manual include:

Conservation Tillage

Conservation tillage allows crop residue (plant materials from past harvests) to remain on the soil surface to reduce runoff and soil erosion, conserve soil moisture, hold nutrients and pesticides on the field, and improve overall soil, water, and air quality. Conservation tillage involves planting and growing crops with minimal disturbance of



Figure 16: Sugarcane field practicing conservation tillage (foreground)

the surface soil. No-till farming, a form of conservation tillage, is used to seed the crop directly into vegetative cover or crop residue without disturbing the surface soil. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment that leaves much of the vegetative cover or crop residue intact on the surface. The average cost of residue and tillage management in Louisiana is \$25.00/acre (Louisiana Department of Agriculture and Forestry, 2008), and demonstrates a slight to moderate BMP effectiveness.

Practice	Average Costs (\$)/ Unit Type
Cover Crop	20.00/ac
Residue Management	7.50/ac
Filter Strip	150.00/ac
Prescribed Grazing	50.00/ac
Pasture & Hayland Planting	61.25/ac
Streambank and Shoreline Protection	12.96/lf
Terrace	1.40/lf

Table 4: Agricultural BMP Cost (NRCS)

Crop Nutrient Management

Crop Nutrient Management fully manages and accounts for all nutrient inputs and outputs. Nutrient Management Plans (NMPs) ensure nutrients are available to meet crop needs while reducing nutrient runoff from the fields. NMPs prevent excessive nutrient buildup in soils by targeted fertilizer application. A properly designed NMP will test soils and plant tissue for existing nutrient levels, as well as fertilizers (if manure/sludge) to develop application rates that meet expected crop yields. The plan is site-specific and outlines the amount, timing, and placement of fertilizers on each field to prevent over-application and reduce waste. Nutrient management is substantially effective as a BMP in reducing nutrients in runoff. Average cost in Louisiana can range from \$21.00 to \$109.00 per acre, according to the Louisiana Department of Agriculture and Forestry.

Conservation Buffers

Conservation Buffers range from simple grassed waterways to riparian areas. These buffers work by capturing potential pollutants in vegetative strips. Cost of conservation buffers in Louisiana vary \$5.00 - \$150.00 per acre) depending on the types of species used. Buffers are moderately effective at reducing sediment in runoff and substantially effective at removing nutrients, bacteria and organic matter.

6.4 Estimated Costs of Implementation

It is established that the costs of water pollution from urban runoff are significant and can include: fish kills, health concerns of human and/or terrestrial animals, degraded drinking water, diminished water-based recreation and tourism opportunities, economic losses to commercial fishing and aquaculture industries, lowered real estate values, damage to habitat of fish and other aquatic organisms, inevitable costs of clean-up and pollution reduction, reduced aesthetic values of lakes, streams, and coastal areas, and other impacts (Leeds *et al.*, 1993). Often costs for simple BMP solutions pale in comparison. However, cost is an integral part of BMP design.

The cost of constructing any BMP is variable and can be substantial. Several documents have been published that address cost estimating for BMPs, but most of these report only construction costs (Young *et al.*, 1996; Sample *et al.*, 2003). In addition, costs are often documented as base costs and do not include land costs, which according to the U.S. EPA (1999) is the largest variable influencing overall BMP cost.

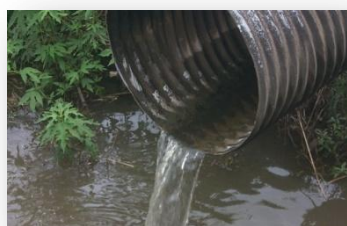


Figure 17 Urban Stormwater Runoff Entering Grand Caillou

BMP Type	Base Capital Costs (\$)	Reference
Detention Ponds/Dry Extended Detention Ponds	$C = 60,742V^{0.69}$; V in Mgal	Young <i>et al.</i> , 1996
	$C = 12.4V^{0.76}$; V in ft ³	Brown and Schueler, 1997
Wet Ponds/Retention Basins	$C = 67,368V^{0.75}$; V in Mgal	Young <i>et al.</i> , 1996
	$C = 24.5V^{0.71}$; V in ft ³	Brown and Schueler, 1997
Constructed Wetlands	$C = 30.6V^{0.71}$; V in ft ³	U.S. EPA, 2003
Infiltration Trenches/Filter Drains/Soakaways	$C = 173V^{0.63}$; V in ft ³	Young <i>et al.</i> , 1996
	$C = 5V$; V in ft ³	Brown and Schueler, 1997
Infiltration Basins	$C = 16.9V^{0.69}$; V in ft ³	Young <i>et al.</i> , 1996
Sand and Organic Filters	$C = KA$; A in acres; K ranges from 12,369 to 24,738	Young <i>et al.</i> , 1996
Vegetated Swales	\$0.25 to \$0.50/ft ²	WERF, 2003
Vegetated Buffer Strips	\$0.30 to \$0.70/ft ²	WERF, 2003
Porous Pavement	\$2 to \$3/ft ²	U.S. EPA, 2003
Bioretention	\$3 to \$4/ft ²	Coffman, 1999
	$C = 7.3V^{0.99}$; V in ft ³	U.S. EPA, 2003; Brown and Schueler, 1997
Water Quality Inlets (enhanced catch basins)	\$8,000 to \$24,000	Young <i>et al.</i> , 1996
	\$2,000 to \$3,000/basin for precast basins	U.S. EPA, 2003
	\$400 to \$10,000/basin for drop-in retrofits	U.S. EPA, 2003

Table 5: BMP Capital Cost Estimates. Costs in December 2002 dollars. Cost of land acquisition not included. V = BMP Volume and A = BMP Area.

The cost for constructing a structural BMP depends on factors such as: the time of year; site conditions and topography; accessibility of equipment; economics of scale; and government regulations. Out of these factors, site conditions and topography are usually the most influential. Site preparation costs may be greatly reduced if existing conditions and vegetation are carefully integrated into the design of any BMP; e.g., a natural depression could be developed into some type of detention pond (Ferguson *et al.*, 1997).

Defining critical agricultural source areas in watersheds can be a challenge due to the hydrologic complexity and natural variability that occurs across the landscape. However, studies show that topographic indices can be used to assist water resource managers in targeting areas where the implementation of BMPs would be most effective (Gowda *et al.*, 2003; Moore and Nieber, 1989; Tomer *et al.*, 2003).

BMPs are developed for a particular site to address a specific nonpoint source pollution concern. The BMP is based on site-specific data gathered and analyzed by a trained and experienced resource specialist. Site data may include soils, slope, climate, topography, crops grown, equipment used, water quality, water quantity, pests, and resource conditions. The conservationist or resource specialist may prescribe a number of alternative practices that not only meet the natural resource objectives, but also meet the landowner/operator's needs and capabilities. Because of the distinctive combination of site characteristics and natural resource objectives, the selected BMP and component practice applied is unique or site-specific.

The USDA Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG) is the source of BMP practices. The FOTG is maintained in each local NRCS Field

Office and includes the standards and specifications for conservation practices designed and adapted to solve local land use concerns and natural resource problems. The Technical Standard for each component practice sets forth the minimum limits of technical excellence for its planning, design and construction. With assistance from the NRCS, development of general estimates for the costs for implementing BMPs for various strategies and practices are recommended in the Bayou Grand Caillou Watershed through their cost-share programs.

Further BMP examples and information on best management practices can be found at <http://www.epa.gov/owow/NPS/ex-bmps.html>.

7.0 Making the Implementation Plan Work

Implementing BMPs and/or other conservation practices to reduce the NPS load in the Bayou Grand Caillou will require programs that provide technical assistance, funding, incentives, as well as foster a sense of stewardship. Several programs that are designed to assist stakeholders are already in place.

The LDEQ's Nonpoint Source Program provides funding distributed through the USEPA under Section 319 of the CWA. The funds are utilized to implement BMPs for all types of land uses within the watershed in order to reduce and/or prevent the NPS pollutants and achieve designated uses. The USDA and NRCS are federal government agencies that have additional programs authorized by the Farm Security and Rural Investment Act of 2002. These programs are made available through the local Soil and Conservation District (SWCD). The NRCS has a list of BMPs for almost all types of programs to facilitate their use.

Parish-wide cooperation and coordination will be necessary in order to protect the water

quality within the watershed. Though challenging, it is an opportunity for leaders, officials, and local citizens to come together for a common interest. The watershed approach helps build new levels of cooperation and coordination, which is necessary to successfully control NPS loading.

7.1 Regulatory Authority: Federal and State Authority

Federal Authority: Section 319 of the Clean Water Act (PL 100-4, February 4, 1987) was enacted to specifically address problems attributed to nonpoint sources of pollution. Its objective is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Sec. 101; PL 100-4), and instructed the Governor of each State to prepare and submit a Nonpoint Source Management Program for reduction and control of pollution from nonpoint sources to navigable waters within the State by implementation of a four-year plan (submitted within 18 months of the day of enactment).

State Authority: In response to the federal law, the State of Louisiana passed Revised Statute 30:2011, signed by the Governor in 1987 as Act 272. Act 272 designated the Louisiana Department of Environmental Quality as the Lead Agency for development and implementation of the State's Nonpoint Source Management Plan. LDEQ's Water Quality Assessment Division was charged with the responsibility to protect and preserve the quality of waters in the State and has developed the nonpoint source management program, ground water quality program and a conservation and management plan for estuaries. These programs and plan were developed in coordination with the other State agencies such as the Department of Natural Resources, the Department of Wildlife and Fisheries, the Department of Agriculture and Forestry and the State Soil and Water Conservation Committees in various

jurisdictions (La.R.S. 30:20). LDEQ's Water Quality Assessment Division is responsible for managing federal funds to implement projects that will restore and improve water quality, providing matching State funds when required, and complying with terms and conditions necessary to receive federal grants.

LAC 33:IX.1101.D of the Louisiana Administrative Code describes the Louisiana water quality standards (LDEQ, 2003). These standards are applicable to surface waters of the state. They are implemented through waste load allocations and LPDES permits for point source discharges to surface waters of the State. The water quality standards also form the basis for TMDL load allocations and by extension planning best management practices for control of nonpoint sources of water pollution.

Chapter 11 of the code also describes the state's anti-degradation policy. LAC 33:IX.1109.A.2 states that the administrative authority shall not approve any wastewater discharge or certify any activity for federal permit that would impair water quality or use of state waters. Discharges must comply with applicable state and federal laws for the attainment of water quality goals. Under this regulation, any new, existing, or expanded point source or nonpoint source discharging into state waters, including land clearing, which is the subject of a federal permit application, is required to provide the necessary level of treatment to protect state waters. Further, the highest statutory and regulatory requirements shall be achieved for all existing point sources and best management practices (BMPs) for nonpoint sources. Additionally, no degradation shall be allowed in high-quality waters that constitute outstanding natural resources, such as waters of ecological significance as designated by the office.

7.2 Actions Being Implemented by LDEQ



LDEQ is presently designated the lead agency for implementation of the Louisiana Nonpoint Source Program. The LDEQ Nonpoint Source Unit provides USEPA §319(h) funds to assist in implementation of BMPs and to address water quality problems on subsegments listed on the §303(d) list. USEPA §319(h) funds are utilized to sponsor cost share, monitoring, and education projects. These monies are available to all private, for profit, and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, federal agencies, or agencies of the State. Presently, LDEQ is cooperating with such entities nonpoint source projects which are active throughout the state.

One LDEQ 319 project was recently completed in the Terrebonne Basin, titled “Urban BMP Training and Education and Home Sewerage Education Awareness.” The goal of this project was to implement an educational program along with an accompanying video, to install construction BMPs at a new South Central Planning Development Commission building site. This program also involved an educational awareness program to help inform local citizens and parish officials on sewerage pollution problems.

In addition, LDEQ has worked to permit eligible facilities in the watershed. LDEQ has issued a Municipal Separate Storm Sewer System (MS4) Discharge Permit for Terrebonne Parish (LAR041023), effective December 5, 2007 through December 4, 2012. The permit authorizes the discharge of storm water from the regulated areas covered by the Terrebonne Parish Consolidated Government Small MS4. The permitted areas include: Terrebonne Parish Small MS4, City of Bayou Cane Small MS4, Town of Chauvin Small MS4, Town of Gray Small MS4, City of Houma Small MS4, Town of Montegut

Small MS4, and the City of Schriever Small MS4. All of these are located within the 2000 U.S. Census-designated Houma Urbanized Area. LDEQ surveillance teams conducted door-to-door sweeps of the Terrebonne Basin in 2007. Facilities discharging wastewater without a permit were provided with applications and encouraged to apply. LDEQ has record of over 40 permitted point source discharges in the Bayou Grand Caillou Watershed (a significant increase from the 4 dischargers modeled in the TMDL).

7.3 Actions Being Implemented by other Agencies



On September 13, 1990, the EPA and the State of Louisiana committed to a cooperative agreement under the National Estuary Program to form the Barataria-Terrebonne National Estuary Program. The program's charter was to develop a coalition of government, private, and commercial interests for the preservation of the Barataria and Terrebonne basins by: identifying problems, assessing trends, designing pollution control, developing resource management strategies, recommending corrective actions, and seeking implementation commitments

BTNEP is currently administered through the Louisiana Universities Marine Consortium (LUMCON). The fundamental goals were delineated in 1992 by a management conference. These goals are (1)to preserve and restore wetlands and barrier islands; (2)realistically support diverse, natural biological communities; (3)develop and meet water quality standards that adequately protect estuarine resources and human health; (4)promote environmentally responsible economic activities that sustain estuarine resources; (5)generate national recognition and support; (6)implement comprehensive education and awareness programs that enhance public involvement and maintain cultural heritage; (7)create an

accessible, comprehensive database with interpreted information for the public; (8) create clear, fair, practical, and enforceable regulations; (9) develop and maintain multi-level, long-term, comprehensive watershed planning; (10) be compatible with natural processes; (11) forge common-ground solutions to estuarine problems; and (12) formulate indicators of estuarine ecosystem health and balance estuary use.

These goals provide the basis for all action plans found in the Barataria-Terrebonne National Estuary Program's Comprehensive Conservation and Management Plan.

The Barataria-Terrebonne National Estuary Program's challenge is to coordinate all agency and stakeholder efforts related to restoration in the system and to create a sense of environmental stewardship for the natural resources of the estuary complex. The program is focusing on the following issues to effect change and understanding of this complex system (www.btneep.org).



The U.S. Department of Agriculture (USDA) and Natural Resource Conservation Service (NRCS) offers landowners financial, technical, and educational assistance to implement conservation practices and/or BMPs on privately owned land to reduce soil erosion, improve water quality, and enhance crop land, forest land, wetlands, grazing lands and wildlife habitat. The new "Farm Security and Rural Investment Act of 2002", known as the 2002 Farm Bill provides funding to various conservation programs for each state by way of the NRCS and the State's local Soil and Water Conservation Districts (SWCD). Although most of these programs are designed to assist agriculture, there may be cases where they may be utilized for conservation practices for other

land uses. A complete list of agriculture BMPs is provided by the NRCS in the *Field Office Technical Guide* (FTOG). The handbook includes a description of each BMP along with recommended uses.

The Louisiana Department of Agriculture and Forestry now receives USEPA §319(h) funds specifically for the implementation of BMPs in impaired watersheds. For more information regarding these funds, please contact LDAF Office of Soil and Water Conservation.

The 2008 Farm Bill provides funding to various conservation programs for each state by way of the NRCS and local Soil and Water Conservation Districts (SWCD). The following includes a brief summary of the programs available through the local SWCD under the oversight of USDA and NRCS. The descriptions of the programs are general and are subject to change.

Agricultural Management Assistance Program

This program provides cost share assistance to agricultural producers who will voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation into their farming operations. Such practices might include constructing an irrigation structure, planting trees to improve water quality, or resource conservation practices such as soil erosion control.

Environmental Quality Incentives Program (EQIP)

EQIP was reauthorized in the 2008 Farm Bill to provide farmers with a voluntary conservation program that promotes agricultural production and environmental quality as compatible goals. This program offers financial and technical assistance to eligible participants in developing management practices on their agricultural land.

Conservation Reserve Programs (CRP)

The CRP provides technical and financial assistance to eligible farmers and ranchers (on a voluntary basis) to address soil, water and related natural resource concerns to protect highly erodible and environmentally sensitive lands.

Watershed Operations

Watershed Operations is a voluntary program under the authority of the Watershed Protection and Flood Prevention Act of 1954 (P.L. 83-566 and by the Flood Control Act of 1944 (P.L. 78-534). Under this program, the NRCS provides technical and financial assistance to states, local governments, and tribes to implement authorized watershed project plans for the purpose of watershed protection, flood mitigation, soil erosion reduction, irrigation water management, sediment control, fish and wildlife enhancement, and wetlands creation and restoration.

Rapid Watershed Assessments

NRCS is encouraging the development of rapid watershed assessments in order to increase the speed and efficiency to guide conservation implementation. In a nut shell, this program will provide quick and inexpensive plans for setting priorities in a watershed and taking action.

Wetlands Reserve Program

This voluntary program provides technical and financial assistance from the NRCS to help landowners in protecting, restoring and enhancing wetlands on their property. The goal of this program is to achieve the greatest wetland functions and values along with optimum wildlife habitat on all wetlands enrolled in the program.

Wildlife Habitat Incentives Program (WHIP)

WHIP is a voluntary program for those interested in developing and improving wildlife habitat primarily on private land. Technical assistance and up to 75% cost share assistance is provided in order to establish and improve fish and wildlife habitat. WHIP agreements between NRCS and the participant generally last from 5 to 10 years.

Master Farmer Program

The Louisiana State University Agricultural Center developed the Master Farmer Program. This voluntary program is based on educating farmers about environmental stewardship, resource based production, and resource management. Becoming a certified Master Farmer involves classroom instruction on water quality regulations, conservation practices, crop specific best management practices and implementation, and USDA conservation funding. Participants also visit model farms to view the implementation of best management practices. Finally, a farm specific conservation plan is developed. "Master farmers" set an example for the agricultural community to become involved in implementing best management practices and helping control non-point source pollution.

Small Watershed Rehabilitation Program (SWRP)

SWRP provides essential funding for the rehabilitation of aging small watershed impoundments and dams that have been constructed over the past 50 years.

"Sodbuster" is a conservation compliance requirement that was established by the 1985 Farm Bill to discourage plowing of erosion-prone grasslands for use as cropland. Eligibility for

program benefits is tied to an approved conservation plan. Compliance is required.

“Swampbuster” was established in the 1985 Farm Bill as a conservation compliance mechanism to discourage draining of wetlands for use as cropland. Eligibility for program benefits can be lost for any wetland converted after 12/23/85. Compliance is required.

In addition to the programs mentioned, the following organizations have signed an MOU with LDEQ outlining how each will aid LDEQ in achieving the goals of the management plan:

- Louisiana Department of Agriculture and Forestry (LDAF)
- Louisiana Department of Health and Hospitals (LDHH)
- Louisiana Department of Wildlife and Fisheries (LWF)
- Louisiana Department of Transportation and Development (LA DOTD)
- Louisiana Department of Natural Resources (LDNR)
- Louisiana State University Agricultural Center (LSU AgCenter)
- Natural Resources Conservation Service (NRCS)
- United States Department of Agriculture (USDA)– Farm Services Agency
- Louisiana Forestry Association
- US Fish and Wildlife Service (USFWS)
- USDA Forest Service
- US Army Corps of Engineers (USACE)
- US Geological Survey (USGS)
- Federal Emergency Management Agency (FEMA)



Figure 18: Headwaters through residential area

7.4 Implementation and Maintenance

The implementation of management measures, best management practices, and conservation practices to reduce nonpoint source pollution in the Bayou Grand Caillou watershed will require the cooperation of citizens, stakeholders, and local governments. Public participation and voluntary action in Bayou Grand Caillou are vital. Citizens need to be informed of the BMP options and how they work to benefit the community. A public education program can greatly improve the feasibility of implementing effective BMPs to protect water quality. Informed citizens can be helpful in supporting and assisting monitoring and enforcement programs.

Tables 5 and 6 show potential BMP projects for the Bayou Grand Caillou Watershed along with construction cost estimates. A more in-depth list for this area can be found at <http://efotg.nrcs.usda.gov/treemenuFS.aspx> under Section I.D.

Practice Code	Practice Name	Component	Unit Type	2008 State Average Cost (\$)
327	Conservation Cover	Native species, 1 to 2 species (seedbed prep, seed, planting)	ac	92
329	Residue and Tillage Management, No-Till/Strip-Till/Direct Seed	No Till	ac	25
330	Contour Farming	Contour Farming	ac	5
340	Cover crop	Establishment of small grain for seasonal cover	ac	31
350	Sediment Basin	Sediment Basin (installed, mobilization, earthwork, outlet structure)	cy	2.45
386	Field Border	Native species, 1 to 2 species (seedbed prep, seed, planting)	ac	92
393	Filter Strip	Native species, 1 to 2 species (seedbed prep, seed, planting)	ac	92
590	Nutrient Management	Precision Agriculture - with Yield Monitor	ac	36
601	Vegetative Barrier	Native species (seedbed prep, seed, planting)	lf	0.05
612	Tree/Shrub Establishment	Hardwood Bare Root Seedlings (Riparian Forest Buffer ONLY) (Planting included)	ac	135
638	Water and Sediment Control Basin	Water and Sediment Control Basin (installed, mobilization, earthwork, outlet structure)	cy	2.4
ac=acre ea=each lf=linear feet sf=square feet cy=cubic yard				

Table 6: NRCS Conservation Practice Codes with estimated 2008 construction costs

8.0 Timeline for Implementation

LDEQ has implemented a watershed approach to ambient water quality monitoring. Beginning in 2004 LDEQ changed from a five-year rotating

monitoring cycle to a four-year cycle. This change allows for the same level of water quality monitoring over a shorter period of time. At the same time, it allows regional field staffs responsible for the sampling to more evenly distribute their monitoring workload. The four-year cycle will also permit a more balanced schedule of water quality assessments for Integrated Reporting (305(b) and 303(d)) purposes.

Within each basin, all monitored subsegments will be sampled over the year or years specified under each cycle period. Water quality assessments for the Integrated Report will be conducted for each basin following the last year of its monitoring period. Sampling in the Terrebonne Basin, , was conducted in 04-05 and will reoccur in 08-09. (Table 7).

Basin	First 4 Year Cycle	Second 4 Year Cycle
Mermentau	2004 -2007	2008-2011
Vermilion-Teche	2004 -2007	2008-2011
Calcasieu	2004, 2005	2008, 2009
Ouachita	2004, 2005	2008, 2009
Barataria	2004, 2005	2008, 2009
Terrebonne	2004, 2005	2008, 2009
Mississippi	2004, 2005	2008, 2009
Pontchartrain	2006, 2007	2010, 2011
Pearl	2006	2010
Red	2004 -2007	2008-2011
Sabine	2006, 2007	2010, 2011
Atchafalaya	2004, 2005	2008, 2009

Table 7: Implementation Timeline

Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the

first TMDLs will have been implemented by the time the first priority basins will be monitored again in the second four-year cycle. This will allow LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs.



Figure 19 Confluence of Grand Caillou and Pelton

8.1 Tracking and Evaluation

As stated in the Louisiana Nonpoint Management Plan, program tracking will be done at several levels to determine if the watershed approach is an effective method to reduce nonpoint source pollution and improve water quality:

- Tracking of actions outlined with the Watershed Restoration Action Strategy (short-term)
- Tracking of BMPs implemented as a result of Section 319, EQIP, or other sources of cost-share and technical assistance within the watershed (short term);
- Tracking progress in reducing nonpoint source pollutants, such as solids, nutrients,

and organic carbon from the various land uses (rice, soybeans, crawfish farms) within the watershed (short-term);

- Tracking water quality improvement in the bayou (i.e. decreases in total organic carbon, total dissolved; oxygen) (short and long term)
- Documenting results of the tracking to the Nonpoint Source Interagency Committee, residents within the watershed, and EPA (short and long term);
- Submitting semi-annual and annual reports to EPA which summarize results of the watershed restoration actions (short and long term);
- Revising LDEQ's web-site to include information on the progress made in watershed restoration actions, nonpoint source pollutant load reductions, and water quality improvement in the bayou (short and long term).

9.0 Summary of the Watershed Implementation Plan

Watershed restoration and protection is about watershed stakeholders working together to develop a watershed community. The community will identify problems, set goals and develop a cost-effective plan to achieve those goals. A watershed's stakeholders include everyone that has an interest in the watershed from watershed residents and businesses to local, state and federal government.

Education is a critical element for accomplishing the goals and objectives of this plan. It is vital that residents and community officials understand and support efforts to implement BMPs. Successful outcomes are more likely

when citizens understand what is occurring and why. When stakeholders volunteer to demonstrate conservation practices on their land they should receive positive recognition and other incentives, therefore positively reinforcing others to do the same. Public education is a proactive approach to many nonpoint source pollution problems and encourages the community to take action without additional regulation.

Primary land uses in the Bayou Grand Caillou watershed are urban and suburban development (primarily residential subdivisions) and agriculture. For each of these land uses, BMPs have been developed to reduce NPS pollutant loading to the watershed. Preventing runoff containing sediment and excess nutrients within the Bayou Grand Caillou can improve water

quality in the Bayou and lead to attainment of the existing uses and the designated uses assigned by the Louisiana Administrative Code.

Urban stormwater runoff BMPs should be implemented and practiced and homeowners should be educated about proper care and maintenance of on-site treatment systems. Agricultural BMPs to reduce sediment and nutrient runoff to the watershed should be implemented where feasible.

This plan provides an overview of the BMP options and a recommended course of action. A consolidated list of BMPs by land use can be viewed in the Louisiana Water Quality Management Plan, Volume 7, *Louisiana's Nonpoint Source Management*, 2005.



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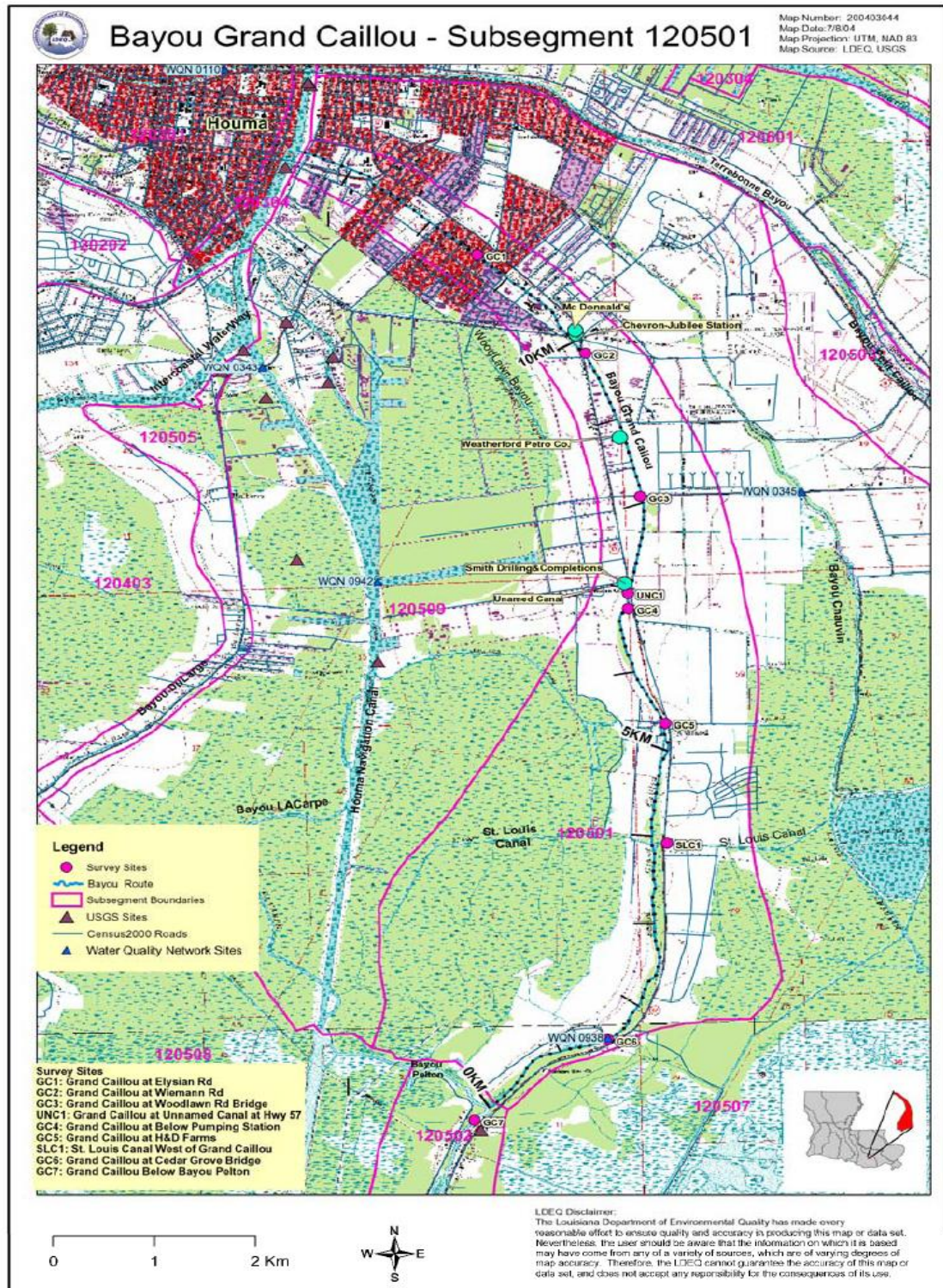
Photograph References

Figure 13: LSU Ag Center. (2008). *Sugarcane harvest better than expected.*
http://www.lsuagcenter.com/en/crops_livestock/crops/sugarcane/harvesting_processing/Sugarcane+harvest+better+than+expected.htm.

Appendix A

MAPS

Bayou Grand Caillou Watershed TMDL
 Subsegment 120501
 Originated: January 21, 2005

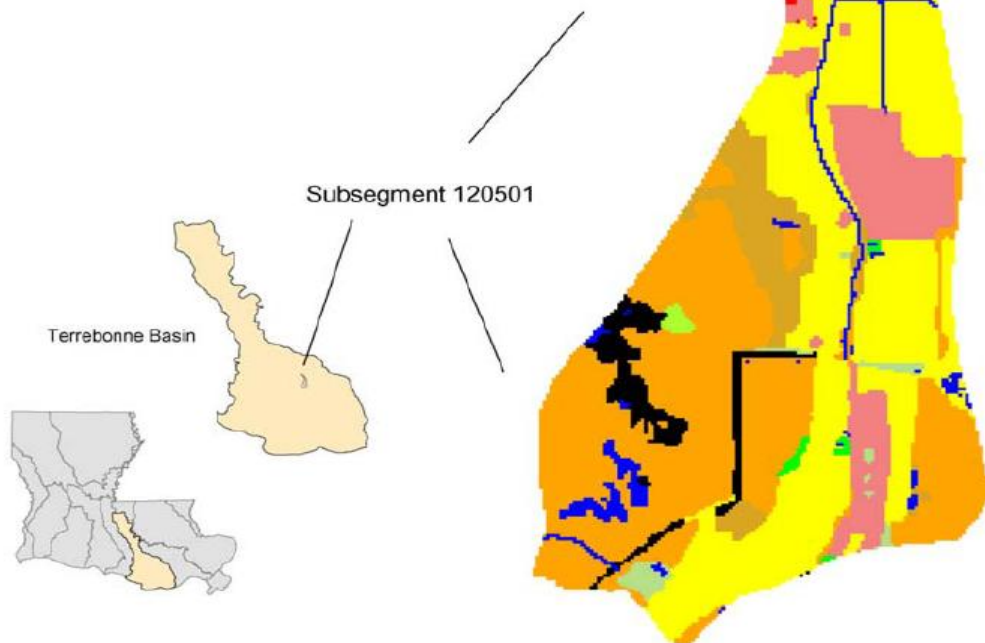


Bayou Grand Caillou Watershed TMDL
 Subsegment 120501
 Originated: January 21, 2005

LDEQ Basin Subsegment 120501 - Bayou Grand Caillou

USGS Louisiana GAP Land Cover

Map Date: 12/09/03
 Map number: 200301109
 Map sources: LDEQ basin-subsegment data,
 USGS Louisiana GAP Data
 Map projection: UTM Zone 15; NAD 27



LDEQ Disclaimer: The Louisiana Department of Environmental Quality (LDEQ) has made every reasonable effort to ensure quality and accuracy in producing this map or data set. Nevertheless, the user should be aware that the information on which it is based may have come from any of a variety of sources, which are of varying degrees of map accuracy. Therefore, LDEQ cannot guarantee the accuracy of this data set, and does not accept any responsibility for the consequences of its use.

0 0.25 0.5 1 1.5 2 Miles

Appendix B

Model Layout

Bayou Grand Caillou Model Layout

